



Limited Visual Dam Safety Inspection Summary Report

MA-076

Maui Reservoir 33

Maui, Hawaii

Prepared by:

**U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT**

**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

May 2006

Limited Visual Dam Safety Inspection Conducted on: 03 April 2006

I. Purpose

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections are authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statutes, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections are being conducted under joint agreements of the U.S. Army Corps of Engineers (USACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection will be made on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works would include the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may appear to be no immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

<u>Organization</u>	<u>Name /Title</u>
U.S. Army Corps of Engineers	Troy O'Neal, P.E. Geotechnical Engineer
U.S. Army Corps of Engineers	Jon Kolber, P.E. Geotechnical Engineer
State of Hawaii, Dept. of Land and Natural Resources	Gordon Chong Engineering Division
State of Hawaii, Dept. of Land and Natural Resources	Gary Tau'a Div. of Forestry & Wildlife

VI. Owner's Representatives Present

Hawaiian Commercial & Sugar Company	Randall Moore
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VII. Summary Report Team

<u>Organization</u>	<u>Name</u>
U.S. Army Corps of Engineers	Derek Chow Bill Empson
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel Edwin Matsuda

VIII. Dam Type

The dam appeared to be an earthen embankment dam.

IX. Dam Classification

The current hazard classification of this dam is: High

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Most likely small but insufficient information is available to inspectors to make a determination.

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

X. Summary of Inspection

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

A. General appearance:

The embankment, spillway and inlet channel are complete and store water. The basin is approximately 33' deep from the top of the embankment to toe. The dam is surrounded by sugar cane fields and is used to provide irrigation to the downstream crops. Above intake flume and below downstream of the spillway and outlet works are diversion channels used to control inflow\outflow and divert excess drainage into dam system.

The reservoir appears to have a significant drainage area.

Findings and Corrective Actions:

- a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- b. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- c. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- d. Routine inspection logs were not inspected.
- e. Access to site appears to be satisfactory.
- f. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- g. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- h. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
- i. Power / Communication: There were no communication systems observed on this reservoir.

B. Access / Security:

Access to the dam was accomplished via a County roadway. A four-wheel drive vehicle is not required.

Security issues: Access to the dam is unrestricted.

C. Intake Works: (Satisfactory)

The intake ditch and pipes are in good condition. The intake ditch is 7' by 4' and is rectangular in shape and is lined with concrete. A gate controls the ditch.

Findings and Corrective Actions:

- a. The intake works were not tested.
- b. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.

D. Reservoir: (Fair)

The reservoir level during inspection was 23.5 per gage, and the normal operating level is 25.0 per gage. The pool elevation is closely maintained twice a day. A staff gage is made out of PVC pipe that is marked and located near the downstream right abutment.

Findings and Corrective Actions:

- a. The reservoir appeared to be in fair to poor condition and requires corrective action. Specifically, removal of vegetation overgrowth and replacement of cut toe material due to maintenance road is recommended.

E. Upstream Slope: (Fair)

The upstream slope was 1 on 1. Minor erosion was observed on the upstream slope. There was one minor slough/steep slope that was likely due to wave action was observed at the time of inspection.

Findings and Corrective Actions:

- a. The reservoir appeared to be in fair to poor condition and requires corrective action. Remove overgrowth.
- b. The upstream slope was not visible due to high grass and bush visual inspection. Clear high vegetation and maintain low to enable easy visual inspection.
- c. Tree(s) were observed on the dam embankment. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstruction the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

F. Crest: (Fair)

The dam crest was approximately 20 feet wide. There was a walking path to the access of the crest; however, it was overgrown with bushes or tall grass.

Findings and Corrective Actions:

- a. The dam crest appeared to be in fair to poor condition and requires corrective action. There is heavy overgrowth of vegetation that should be removed to facilitate inspection.
- b. Access along the crest was difficult due to vegetation overgrowth.
- c. Portions were not visible due to high grass and bush visual inspection. Clear high vegetation and maintain low to enable easy visual inspection.
- d. Tree(s) were observed on the dam embankment. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and

reconstruction the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

G. Downstream Slope: (Fair)

The downstream slope was approximately 1.5 on 1. The downstream slope had tall grass and trees and was not visible due to this heavy vegetation. There was no access other than on foot to the downstream slope and toe. Minor erosion was observed on the east side downstream slope. Sinkholes were not observed on the downstream slope. Seepage was not observed on the downstream toe.

Findings and Corrective Actions:

- a. The downstream slope appeared to be in fair to poor condition and requires corrective action. Remove trees.
- b. The down stream slope was not visible due to high grass and bush visual inspection. Clear high vegetation and maintain low to enable easy visual inspection.
- c. Tree(s) were observed on the downstream slope. Trees have been identified as the probable cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstruction the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

H. Abutments / Toe: (Fair)

The abutments and toe for erosion, cracks and seepage were not observed. The abutments and toe had bushes and tall grass.

Findings and Corrective Actions:

- a. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
- b. Minor undercutting in discrete locations at the toe due to maintaining the access road was observed. Recommendation is to replace the material.

I. Outlet Works: (Satisfactory)

The outlet works consisted of a 24" diameter pipe that was located on the downstream side of the dam. The system appeared to be working at the time of inspection.

Findings and Corrective Actions:

- a. The outlet works were not tested.
- b. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

J. Spillway: (Satisfactory)

This spillway consisted of a concrete lined channel that is 4' by 3'. The spillway approach was clear. There was no erosion observed near the spillway.

Findings and Corrective Actions:

- a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

K. Down Stream Channel: (Unknown)

There is a well-defined downstream diversion channel that is concrete lined.

Findings and Corrective Actions:

- a. The downstream channel was not inspected.

XI. Additional Comments:

Based on visual observations and discussion of operational procedures of the dam, there is no immediate threat to the safety of the dam at this time.

Heavy growth of vegetation needs to be removed to promote proper inspection of slopes.

Some toe areas were cut to maintain the access road. Material should be properly replaced.

PHOTOGRAPHS

MA-076 Maui Reservoir 33

MA-076 Maui Reservoir 33



076 Crest Growth - View of crest of dam and numerous trees and overgrowth.

MA-076 Maui Reservoir 33



076 Downstream embankment cane
and trees at top of slope

MA-076 Maui Reservoir 33



076 downstream slope with toe cut from road maintenance

MA-076 Maui Reservoir 33



076 View of downstream slope of right embankment and access road.

MA-076 Maui Reservoir 33



076 View of downstream toe cut from road maintenance and subsequent erosion

MA-076 Maui Reservoir 33



076 View of erosion downstream toe near downstream/right embankment junction

MA-076 Maui Reservoir 33



076 Downstream slope - cover along downstream slope looking toward left end of dam.

MA-076 Maui Reservoir 33



076 View of impoundment looking upstream toward inlet channel.

MA-076 Maui Reservoir 33



076 View of channel to from inlet to reservoir looking downstream

MA-076 Maui Reservoir 33



076 View of channel to from inlet to reservoir looking upstream

MA-076 Maui Reservoir 33



076 View of inlet entrance from diversion channel looking downstream

MA-076 Maui Reservoir 33



076 View of inlet flume looking upstream

MA-076 Maui Reservoir 33



076 View of right end crest that was heavily overgrown with trees and brush

MA-076 Maui Reservoir 33



076 View of downstream slope and ground cover for left embankment

MA-076 Maui Reservoir 33



076 View of downstream slope and ground cover for left embankment

MA-076 Maui Reservoir 33



076 View of upslope trees growth and overgrowth of left embankment

MA-076 Maui Reservoir 33



076 View of outlet valve (working) at DS toe and diversion channel

MA-076 Maui Reservoir 33



076 View of possible animal burrow on right embankment crest

MA-076 Maui Reservoir 33



076 Right Crest - View of inaccessible right end crest that was heavily overgrown

MA-076 Maui Reservoir 33



076 Spillway and Outlet Works - View of spillway flume DS and adjacent outlet works/diversion

MA-076 Maui Reservoir 33



076 staff gage located near right downstream end of reservoir

MA-076 Maui Reservoir 33



076 Downstream Slope - downstream slope angle near right embankment.

FIELD INSPECTION SHEETS

Dam ID: MA-0076
RESERVOIR 33

Vulnerability Index:
Extreme High Moderate Low
1 2 3 4

Inspection No: _____
Date: 4/3/06

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present

Affiliation

Phone Number

<u>TROY O'NEAL</u>	<u>US Army Corps of Engineers</u>	
<u>JON KOLBER</u>	<u>'</u>	
<u>GORDON CHONG</u>	<u>DLNR</u>	
<u>GARY TAV'A</u>	<u>DLNR</u>	

Weather Condition: ☐ Rain previous day ☐ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☐ Partly Cloudy ☒ Sunny ☐ Dry

Comments: _____

1. General: (Information currently on file, update as required)

Dam/Res. Name	<u>RESERVOIR 33</u>		
Owner	<u>Hawaiian Commercial & Sugar Company, a division of Alexander & Baldwin, Inc.</u> (C010)		
Owner Contact	<u>Mr. Randall Moore</u>	Owner Ph.	_____
Lessee	<u>N/A</u>	Lessee Ph.	_____
O & M Contractor	<u>HC&S</u>	O & M Ph.	_____
Nearest Town	<u>SPRECKLESVILLE</u>	Latitude	<u>20.85 ° (decimal)</u>
County	<u>MAUI</u>	Longitude	<u>156.37 ° (decimal)</u>
Tax Map Key(s)	<u>(2)2-5-002:002</u>		

Dam Status	<u>A:</u>	Hazard Potential	<u>H:</u>	Dam Size	_____
Year Completed	<u>1910</u>	Dam Length	<u>1200</u> ft.	Dam Height	<u>33</u> ft.
Normal Storage	<u>143 ac.ft.</u>	Max. Storage	<u>149</u> ac.ft.	Max. Surface Area	_____ ac.
Drainage Area	_____ mi.	Spillway Type	_____	Max. Spillway Q	_____ cfs

Owner owns land under dam facility: _____

Emergency Action Plan on file with the Department: NO

Reports on file with the Department: None on file.

Dam ID: MA-0076

RESERVOIR 33

Inspection No: _____

Date: 4/3/06

2. Questions for Owner's Rep.:

	Yes	No	Unknown	Comments
Construction Plans Available	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	NO RECORD (BUILT 1910)
Site / Facility Map	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	GENERAL SITE MAP
Operation & Maintenance Manual	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	NONE
Emergency Action Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	NONE
Modifications / Improvements	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AS NEEDED
Conduct Routine Inspections	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	CHECKED 2/DAY FOR IRRIGATION PURPOSES
Conduct Routine Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AS NEEDED OF INLET/OUTLET MECHICAL SYSTEMS
Vehicle access to site	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible <input type="checkbox"/> With Standard car <input checked="" type="checkbox"/> Requires 4-Wheel Drive
Access during heavy rains	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible <input type="checkbox"/> With Standard car <input checked="" type="checkbox"/> Requires 4-Wheel Drive
Access when spillway is flowing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible <input type="checkbox"/> With Standard car <input checked="" type="checkbox"/> Requires 4-Wheel Drive
Other Studies Conducted	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Phase I <input type="checkbox"/> Phase II <input type="checkbox"/> Hydraulics <input type="checkbox"/> Stability <input type="checkbox"/> Hazard <input type="checkbox"/> Seismic <input type="checkbox"/> Other: _____
Incident History	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Breached <input checked="" type="checkbox"/> Overtop <input type="checkbox"/> Slide <input type="checkbox"/> Down stream Flooding <input type="checkbox"/> Other: BEFORE 1980'S (REPORTED - NO DAMAGE)
Reservoir's Current Use	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Sediment <input checked="" type="checkbox"/> Irrigation <input type="checkbox"/> Recreation <input type="checkbox"/> Flood Control <input type="checkbox"/> Drinking Water <input type="checkbox"/> Power Generation <input type="checkbox"/> Other: _____

Findings and Corrective Actions:

- ☒ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☒ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☐ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☒ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☒ f. Routine inspection logs were not inspected.
- ☐ g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☒ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☒ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☒ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required Recommended

- | | | |
|--------------------------|-------------------------------------|--|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | Phase I Study |
| <input type="checkbox"/> | <input type="checkbox"/> | Phase II Study (Including <input type="checkbox"/> Seepage <input type="checkbox"/> Hydrology/Hydraulics <input type="checkbox"/> EAP) |
| <input type="checkbox"/> | <input type="checkbox"/> | Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity) |
| <input type="checkbox"/> | <input type="checkbox"/> | Stability Analysis |
| <input type="checkbox"/> | <input type="checkbox"/> | Seismic Analysis |
| <input type="checkbox"/> | <input type="checkbox"/> | Hazard Classification |
| <input type="checkbox"/> | <input type="checkbox"/> | Other: _____ |

Dam ID: MA-0076

RESERVOIR 33

Inspection No: _____

Date: 4/3/06

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)**3. Reservoir:**Level during inspection 23.5 ft per GAGE (gage / other)Normal Operating Level/Range 25.0 ft per GAGE (gage / other)Description: POOL ELEV. CLOSELY MAINTAINED (2/DAY)Typical Operation ☐ Spillway always flowing ☒ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☐ Only filled by Storms
☐ Other: _____Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Staff Gage: Description: PVC PIPE MARKED AND LOCATED NEAR DS RIGHT ABUTMENT**Findings:**

- ☐ a. The reservoir was not inspected.
- ☐ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The reservoir appeared to be in fair to poor condition and requires corrective action. ← EXCEPT TO REMOVE VEGETATION OVERGROWTH
- ☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ e. The staff gage needs maintenance and/or repair. Description: _____
- ☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
- ☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
- ☐ h. _____

4. Intake Works Description:

Number of Intakes _____

☐ Intake Culvert / PipeSize: _____ in. ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or BypassedFrom: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____☒ Ditch / FlumeDimension: 7' x 4' (Size x Depth) Shape RECTANGLESurface: ☐ Dirt ☐ Wood ☐ Concrete ☒ Lined w/ CONCRETEControl: ☒ Gate ☐ Valve ☐ Flow can either be Shut off or BypassedFrom: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☒ Other DITCH KAHIKOA**Findings:**

- ☐ a. The intake works were not inspected.
- ☒ b. The intake works were not tested.
- ☒ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ f. The intake works needs maintenance and/or repair. Description: _____
- ☐ g. _____

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5. Upstream Slope:

(Typical Slope ± 2 : 1)

Slope Protection: ☐ None ☐ Dumped Rock ☒ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner ☐ Other: _____

☐ Defect in Protection: Description: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: one minor slough (steep slope)

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☒ Bushes or Tall Grass ☒ Trees # 10 ☐ <6" ☒ >6" & <20" ☐ >20"

Description: sporadic trees

Findings:

- ☐ a. The upstream slope was not inspected.
- ☐ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The upstream slope appeared to be in fair to poor condition and requires corrective action. (REMOVE OVERGROWTH)
- ☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☒ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☒ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ k. _____

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RESERVOIR 33

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6. Crest:

Approximate Crest Width: 20'

Access: ☐ None ☒ Walking Path ☐ Roadway, Surface / Width / Usage: overgrown

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Findings:

- ☐ a. The dam crest was not inspected.
- ☐ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The dam crest appeared to be in fair to poor condition and requires corrective action. (HEAVY OVERGROWTH)
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Access along the crest was satisfactory.
- ☒ f. Access along the crest was not possible. Description: DIFFICULT DUE TO VEGETATION OVERGROWTH
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☒ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☒ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

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Date: 4/3/06

7. Downstream Slope:

(Typical Slope \pm 1.5 : 1)Access: ☒ lower roadway along toe ☐ roadway to outlet works ☐ walkway to outlet works ☐ None ObservedSlope Protection: ☒ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ ConcreteErosion: ☒ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: loose soil at several points along toe

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☒ Bushes or Tall Grass ☒ Trees # 10 ☐ <6" ☒ 6" & <20" ☐ >20"

Description: _____

Seepage: Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed☐ Flowing, Description: _____Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed☐ Flowing, Description: _____Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The downstream slope was not inspected.
- ☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The downstream slope appeared to be in fair to poor condition and requires corrective action. (REMOVE TREES)
- ☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☒ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☒ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.
- ☐ k. _____

8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed
 Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed
 Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"
 Description: _____

Seepage: Seep Spot Number 1
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed
☐ Flowing, Description: _____
 Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
 Description: _____

Seep Spot Number 2
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed
☐ Flowing, Description: _____
 Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____
 Description: _____

Findings:

- ☐ a. The abutments/toe were not inspected.
- ☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair.
 Description: _____
- ☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.

☒ l. MINOR UNDERCUTTING DUE TO MAINTAINING ACCESS ROAD. REPLACE MATERIAL IN DISCRETE LOCATIONS AT TOE

9. Outlet Works:Culvert / Pipe

Type / Size: 24" DIAMETER

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____Pipe: ☒ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____Control Type: ☐ Gate ☒ Valve ☐ Other _____Location: ☐ Control on Upstream side ☒ Control on Downstream sideSeepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed☐ Flowing, Description: _____Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The outlet works were not inspected.
- ☒ b. The outlet works were not tested.
- ☒ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.
- ☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. _____
- ☐ j. _____

Dam ID: MA-0076

RESERVOIR 33

Inspection No: _____

Date: 4/3/06

10. Spillway:

Type:

☐ None ☐ Culvert/Pipe ☒ Channel

Description: CONCRETE LINED

Dimension: 4' X 3' ft. Invert elevation: _____ ft. per staff gage

Slope Protection: ☐ None ☐ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☒ Concrete

☐ Defect in Protection: Description: _____

Approach: ☒ Clear ☐ High Veg. ☐ Trees ☐ Other: _____

Erosion: ☐ Scour ☐ Gully ☐ Headcut ☒ Not Observed ☐ Other: _____

Description: _____

Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Findings:

- ☒ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
- ☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ d. Slope protection needs maintenance or repair. Description: _____
- ☐ e. The spillway approach was blocked. Clear approach.
- ☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
- ☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
- ☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
- ☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
- ☐ j. _____

11. Down Stream Channel:

Name: N/A

Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☒ Defined Drainage-way ☐ Other _____

Items along Stream Bank: ☐ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected

Description: IRRIGATION CHANNEL (CONCRETE LINED)

Findings:

- ☒ a. The downstream channel was not inspected.
- ☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. _____

Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

~~REMOVED~~

- 1) BASED ON VISUAL OBSERVATIONS AND DISCUSSION OF OPERATIONAL PROCEDURES OF THE DAM, THERE IS NO IMMEDIATE THREAT TO THE SAFETY OF THE DAM AT THIS TIME.
- 2) HEAVY GROWTH NEEDS TO BE REMOVED TO PROMOTE PROPER INSPECTION OF SLOPES.
- 3) SOME TOE AREAS CUT TO MAINTAIN ACCESS ROAD. MATERIAL SHOULD BE PROPERLY REPLACED.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statutes Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.